

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau



(43) International Publication Date
31 March 2005 (31.03.2005)

PCT

(10) International Publication Number
WO 2005/028975 A3

(51) International Patent Classification⁷: **F25J 1/02**,
F25B 9/02

F25J 1/02,

(72) Inventors; and

(21) International Application Number:
PCT/GB2004/004047

(75) Inventors/Applicants (for US only): BAUER, Heinz [DE/DE]; Gartenstrasse 12, 82067 Ebenhausen (DE). FRANKE, Hubert [DE/DE]; Gislstrasse 27, 82049 Pullach (DE). SAPPER, Rainer [DE/DE]; Zugspitzstrasse 9, 82335 Aufkirchen (DE). SCHIER, Marc [DE/DE]; Südliche Müncher Strasse 21, 82031 Grünwald (DE). BÖLT, Manfred [DE/DE]; Herbststrasse 33, 82194 Gröbenzell (DE). PETTERSEN, Jostein [NO/NO]; Johannes Minsaas vei 12, N-7053 Ranheim (NO). FREDHEIM, Arne, Olav [NO/NO]; Tingveien 21C, N-7046 Trondheim (NO). PAUROLA, Pentti [FI/NO]; Buseneset 26, N-4046 Hafsfjord (NO).

(22) International Filing Date:
23 September 2004 (23.09.2004)

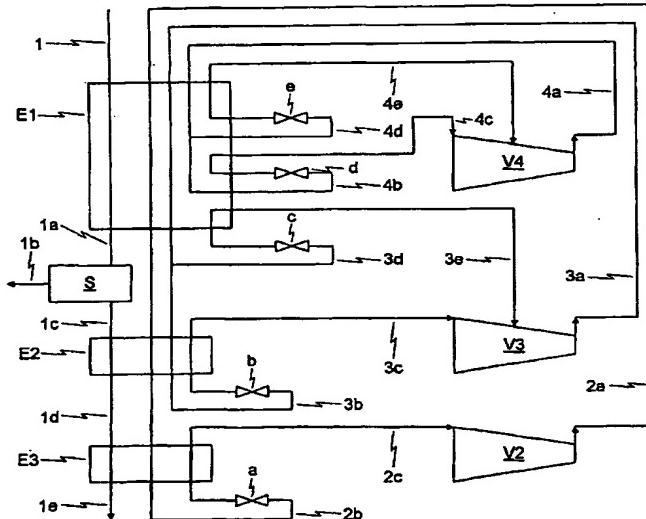
(74) Agent: JACKSON, Robert; Frank B. Dehn & Co., 179 Queen Victoria Street, London EC4V 4EL (GB).

(25) Filing Language: English
(26) Publication Language: English
(30) Priority Data:
10344030.5 23 September 2003 (23.09.2003) DE
0409103.9 23 April 2004 (23.04.2004) GB

(71) Applicants (for all designated States except US): STATOIL ASA [NO/NO]; I & K IR PAT, N-4035 Stavanger (NO). LINDE AKTIENGESELLSCHAFT [DE/DE]; Abraham-Lincoln-Str. 21, 65189 Wiesbaden (DE).
(71) Applicant (for MG only): JACKSON, Robert [GB/GB]; Frank B. Dehn & Co., 179 Queen Victoria Street, London EC4V 4EL (GB).
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,

[Continued on next page]

(54) Title: NATURAL GAS LIQUEFACTION PROCESS



(57) Abstract: A method of liquefying a hydrocarbon-rich gas, wherein the gas (1) flows through a cascade of three refrigeration stages (E1, E2, E3), each stage comprising a refrigerant circuit and a compressor (V2, V3, V4), wherein at least part (3d) of the flow of refrigerant from the second circuit is used for the pre-cooling (E1) of the hydrocarbon rich gas in the first refrigeration stage. This balances the load on each of the compressors. By standardizing the drive units and compressors of the three coolant circuits, it is possible to maximize the attainable liquefaction capacity of the liquefaction process using tried-and-trusted drive units and compressors respectively. This method can be applied to mixed refrigerant cascades and circuits with a carbon dioxide pre-cooling circuit. This latter option has benefits for offshore use where large amounts of hydrocarbons are undesirable.

WO 2005/028975 A3



TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) **Date of publication of the international search report:**
26 May 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.